Executive Report: Evaluation Findings

Introduction

The PARK Teachers program has created a professional development model that bridges the gap between formal and informal learning communities and institutionalizes best practices among pre-service science teachers by strengthening partnerships between schools of education and national parks. The PARK program has developed innovative ways to improve teachers' access to and use of national parks' educational resources.

The development of the geology module, *Rockin' in the Riprap*, was constructed using the backward design approach to curriculum development. Participants liked the module because it provided a balance between field work and classroom lab activities. Participants appreciated the well designed features of the module and stated they now understood the importance of presenting curriculum in an organized manner. Participants were introduced to new teaching tools such as magic windows, vocabulary review games, and resource materials. All the participants intended to use and/or modify these tools to incorporate into their teaching even if they are not teaching geology.

The most impressive feature of the program, from the evaluator's perspective, was the modeling of inquiry-based learning techniques. Participants realized the importance of letting students figure things out for themselves instead of being taught the "right answer". The program allowed teachers to engage in their own discovery experience and hopefully this will increase the probability that they will incorporate this teaching strategy with future students.

With the exception of a few participants with strong backgrounds in geology, all of the participants reported increasing their knowledge of geology concepts and had a new appreciation for the complexity of geological change in our environment. Participants stated feeling more confident in teaching geological concepts as a result of the program. All the participants indicated that they had a new appreciation for the educational resources available at national parks. In addition to resource materials, teachers realized how access to outdoor areas can be used to supplement their classroom instruction.

Teachers appreciated the opportunity to receive transportation funding to bring students on a field trip to the program. They look forward to checking out "traveling trunks"—containing local rocks with permits, geological maps of the area, and an assortment of other resources that can be loaned to teachers during the academic year. The current development of an interactive website to provide access to teachers unable to attend the program was greeted with enthusiasm from the teachers.

Teachers requested additional curriculum support to help prepare their students before and after a field trip the park. When asked what type of curriculum would be most useful, they recommended the development of a three day module, with extension activities. The ability of the program to support teachers with current resources and additional program components are depended upon the availability of future funding. When teachers request additional curriculum and resources this is a good indication that they value the program and plan to use the park resources in their teaching. Perhaps this is the best measure of the success of the PARK program.

Summary Findings

The primary goal of the PARK program was to create a partnership between National Park Service staff from Golden Gate National Recreation Area and science methods faculty from San Francisco State University to collaboratively design a geology module. The *Rockin' in the Riprap* module, developed for pre-service teachers, focuses on key geology concepts and incorporates inquiry-based learning strategies. The team selected geology as the key content area because the park has natural resources uniquely suited to teaching that subject, and because many new teachers are less confident in their content knowledge and teaching skills in geology.

A total of 36 SFSU pre-service teachers and 46 in-service teachers from across the U.S. participated in the *Rockin' in the Riprap* module and completed the assessment instruments. The project benefited from eliciting feedback from experienced teachers as well as the pre-service teachers, as each group focused on different aspects of the program. Pre-service teachers were most interested in collecting information and gathering the tools to improve their teaching, whereas the experienced teachers' comments focused on content and how they would modify the materials to match their instructional style.

The evaluation plan consists of formative and summative components. The formative evaluation components include documenting the planning process, designing assessment instruments, and monitoring the implementation of the program by providing early and ongoing feedback to the project team. The summative evaluation focuses on assessing the program's overall performance and effectiveness, as well as lessons learned. Qualitative and quantitative indicators, based on direct observation, surveys, and interviews, were utilized throughout the evaluation.

The focus of the pre- and post-program survey assessments was to measure three primary factors: (1) teachers' knowledge about the availability of teaching and/or educational resources in the national parks, (2) teachers' content knowledge in geology, and (3) teachers' confidence in teaching geology to students. These factors were included in a survey instrument that participants completed at the beginning and end of the module. By comparing participants' pre- and post-program survey responses, the team obtained valuable feedback on whether the program was successful in achieving its stated goals. Throughout numerous implementations of the program, the assessments were modified based on participants' feedback and evolving goals of the program.

The evaluation findings are summarized in the following section by program goal.

Create a Partnership.

Much of the success of this project can be attributed to the development of a strong partnership between the National Park Service staff and Kathleen O'Sullivan at SFSU. Clear communication, a good sense of humor, and a commitment to make the project work were key ingredients to strengthening the partnership. Another essential component for the project was the work of the project director, Lynn Fonfa. Under her guidance, the development team continually communicated via meetings, the telephone, and e-mail to confirm recent decisions and discuss next-steps. The success of the project can be attributed to Lynn's ability to know when to push and when to give the group some thinking time. She did a tremendous job of keeping everyone on task.

Develop a Geology Module

Use of the "backward design" approach was critical to this module's success. This approach includes explicitly stating the essential question; determining sufficient evidence that a participant has achieved the goals; and creating alignment between the goals, the content, the teaching strategies, and the assessments. Other important components included developing an inquiry-based investigation; piloting activities and being willing to revise, modify, and/or delete an activity; listening to the feedback of the participants; and concentrating on a few key concepts instead to trying to cover too much material in a short period of time.

All participants agreed or strongly agreed with the statements that the on-campus introduction prepared them for the field experience, the essential question for the geology module was clear, the curriculum and instructional ideas were excellent, and the materials (props, rocks, handouts, etc.) were informative. Likewise, participants (100%) agreed that the program's field component increased their

level of interest and motivated them to learn the material. The participants commented on the importance of “using what we see or experience in our environment to understand specific geological principles.” Most of the participants (89%) commented on the program’s sequence —they “liked the combination of field work and then coming into the lab to examine results.”

Model Inquiry-based Learning.

Participants (94%) rated the program high in educational effectiveness and level of inquiry. When asked to provide a rationale for their rankings, participants expressed appreciation that the program “allowed us to pose our own explanations for what we were observing without the pressure of being right.” Other pre-service teachers stated that “engaging in an inquiry-learning experience helped me realize for the first time how important it is to let students try to figure out how the rocks formed and how they got to where they are.” This statement alone indicated the tremendous success of the project.

All too often, due to time constraints and the pressure for students to achieve on standardized tests, teachers decide to directly teach science concepts instead of developing learning situations in which students can experience the scientific process. When teachers have an opportunity to engage an inquiry-based learning and themselves experience the learning gains, in projects such as PARK Teachers, they are more likely to expose their students to these types of learning environments as well.

Increase in Content Knowledge.

When asked to comment on the effect of the program on their own understanding of geology, most of the participants (83%) indicated that this was their first real exposure to geology content, that the module offered them adequate opportunities to present their ideas, and that they liked a program structure in which they had to provide evidence to support their conclusions during the discussion of findings. All but two of the participants stated that their understanding of evidence for geological change improved after participating in the PARK program. All except three of the participants were more confident in their ability to teach students about plate tectonics and geological processes after participating in the program.

In each case, the participants who did not agree with the statements above indicated “no change” in their understanding of geological change or in their confidence in their ability to teach students about geological change. Six pre-service teachers had an extensive geology background prior to attending the program, so the fact that some of these teachers felt that their understanding of evidence for

geological change had improved as a result of the program, and they were more confident in their ability to teach students geological concepts, was a positive outcome for the project.

National Parks as Educational Resources

All the pre-service teachers agreed or strongly agreed that they had learned new things about the educational resources available at a national park after participating in the PARK program. This experience also enhanced their interest in using field trips as educational supplements to their classroom teaching. One participant summarized it well with the statement, “I think it was effective for my own education to know how much students can get out of a well-planned and -executed field experience in terms of appreciation for environment and others.” Another participant concluded, “I believe the PARK Program would be useful for all teachers as a resource to teach students about science, history, and sustainability.” The pre-service teachers indicated that participation in the PARK program increased their awareness of and interest in informal science education as a supplement to their classroom teaching.

Transfer of Program Components to the Classroom.

Although only a few of the pre-service teachers expected to teach geology, many indicated they planned to use and/or modify instructional materials from the project. All the teachers liked the “Cookie Tectonics” activity, in which a sandwich cookie is used to demonstrate subduction along continental plates, and “Edible Geology,” which uses three different types of candy (jelly beans, Jolly Ranchers, and gum drops) to describe the formation of various rock types (see Teaching Materials in report disc). Most of the teachers commented that these activities helped deepen their understanding of these geological concepts. Likewise, all of the teachers, regardless of subject area, were impressed with the vocabulary review activity called “I have tectonics.” All the pre-service teachers thought this was an inventive technique for students to either learn and/or review scientific vocabulary.

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